How well do we really understand cold nuclear matter?

L. A. Linden Levy for the PHENIX collaboration

July 11, 2008

Abstract

The measurement of charmonium suppression in relativistic heavy ion collisions is posited to be an unambiguous probe of the properties of the strongly interacting quark gluon plasma (sQGP). In hot and dense QCD matter Debye color screening prevents charm and anti-charm quark pairs from forming J/ψ mesons if the screening radius is smaller than the binding radius. However, one must have a clear understanding of the expected suppression in normal density QCD matter before interpreting any additional anomalous suppression.

The PHENIX experiment has measured J/ψ production from colliding proton+proton and deuteron+gold beams at 200GeV from the relativistic heavy ion collider (RHIC). The deuteron+gold data can be compared to the proton+proton baseline in order to establish the typical suppression in cold nuclear matter. For PHENIX, a suppression of J/ψ in cold nuclear matter is observed as one goes forward in rapidity (in the deuteron-going direction), corresponding to a region more sensitive to initial state low-x gluons in the gold nucleus. These results can be convoluted with the nuclear-environment-modified parton distribution functions, measured in DIS, in order to extract the J/ψ break up (absorption) cross section in cold nuclear matter. In this talk I will compare and contrast the PHENIX results with results obtained at E866, SPS, and the HERA-B experiments for J/ψ suppression. One interesting question to ask is how well these different data agree with each-other, or in other words how universal is the J/Psi suppression in cold nuclear matter across different colliding systems and different energies. In addition projections for future results using the data acquired by the PHENIX experiment in Run6 (p+p) and Run8 (d+Au) will be presented. These data, which are in the process of being analyzed, will provide a needed improvement in the statistical and systematic precision of constraints for cold nuclear matter (CNM) effects. These CNM-effect constraints must be improved in order to make firm conclusions concerning additional hot nuclear matter charmonium suppression in the sQGP.